

[Cited Reference 1]

(TRANSLATION)

Japanese Patent Office

Official Laid - Open Patent Gazette

Japanese Laid - Open Patent Publication

(Kokai) No. Hei. 7 - 83457

Laid - Open Date: March 28, 1995

Application No. Hei. 5 - 224276

Application Date: September 9, 1993

Inventors: Koichi Nakano (phonetic) et al

Applicant: Matsushita Denki Sangyo K.K. (phonetic)

Title of Invention: An cleaning machine

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What Is Claimed:

[Claim 1] An cleaning machine characterized by being provided with such a kind of a heater, in a ventilation passage thereof from the suck - in inlet to the blow - out outlet, that may carry, be coated with, be impregnated with a catalyst having an absorbing function or a decomposing function of nitrogen oxide, and carbon monoxide and hydrocarbon or either one of them.  
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Detailed Explanation of the Invention:  
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English translation of page 3:

[0015]

[Examples]:

(Example 1): One Example of the present invention will be explained as follows on the basis of Figure 1. Figure 1 is a sectional view of the air cleaning machine. Code 1 stands for the suck - in inlet which sucks air into a room or a chamber of a vehicle, Code 2 stands for the blow - out outlet for blowing out the air sucked in from the suck - in inlet (1), after cleaning said air. Code 3 stands for a fan, code 4 stands for

a dust collection filter, and code 5 stands for the heater carrying a catalyst provided in the ventilation passage from the suck - in inlet (1) to the blow - out outlet (2).

In the figure, the arrow mark shows an air stream. Here as for the heater 5, a sheathed heater is bent and is positioned as shown in the figure such that it may effectively contact with the air stream. Further as the catalyst to be carried by the heater 5, such a kind of catalyst that may have an absorbing action and a decomposing action in particular to a nitrogen oxide is employed.

[0016] A method of adjusting the catalyst used in the present Example will be shown as follows: A 0.2 mole / l solution was prepared by dissolving ferrous chloride in pure water. An amount four times greater in the weight ratio than that of the ferrous chloride, of urea was added thereto, and the thus resulting mixture was stirred be dissolved. Thereafter it was heated at a rate of 1 °C per one minute from the room temperature and thereafter while the temperature was maintained at 98 °C, it was left for a period of 4 hours thus to mature the iron compound. By this treatment, urea was hydrolyzed thus to produce ammonium ion, and as the result thereof, it produced a precipitation of hydroxide of iron. When a predetermined period of time passed, the iron compound was washed with ion exchange water. After the completion of this washing, the water content was removed by filtering, and it was kept still for a period of time of longer than 3 hours in a drier having a temperature of 110 °C thereby to dry the same for removing the water content. By the treatment as mentioned above, the adjustment of the catalyst was terminated.

[0017] Next by the use of a binder mainly containing alumina, said catalyst was so treated to be carried on the heater 5. Here as the heater 5, a 1000 W sheathed heater having a diameter of 10 mm and a length of 120 cm in the shape (sic) was used. Further the weight of the catalyst to be carried was 10. 0 g in total. As for the shape of the heater of this time, the sheathed heater was bent such that it might effectively contact with the air stream.

[0018] The results of the experiments by the use of the catalyst of the present Example will be reported as follows:

In the present experiment, a predetermined amount of nitrogen oxide was poured into a 2.5 m<sup>3</sup> experiment box and a comparison was made between the case of operating such a kind of said air cleaning machine in which the heater 5 carrying

the catalyst was disposed and the case of operating such a kind of said air cleaning machine in which the heater 5 carrying the catalyst was not disposed. That is, the changes of the concentrations of the nitrogen oxides in the box during the lapse of time were measured and compared. However, at this time, the heater was not switched on. By the way as for the nitrogen oxide compound, the initial concentrations were determined to be 10 ppm for nitrogen monoxide and also 10 ppm for nitrogen dioxide and were measured according to a chemical light emission method.

[0019] The results of these measurements are shown in Figure 2. In Figure 2, the horizontal axis shows the lapse of time and the vertical axis shows the rate of the remaining the nitrogen oxide. As the results of this experiment, it was confirmed that in the case of those provided with the catalyst of the present Example, the attenuation was greater for both of nitrogen monoxide and nitrogen dioxide, as compared with those not provided with the catalyst of the present Example and further that the nitrogen oxides were removed by the absorbing actions of the catalyst.

[0020] The changes in the concentration of the nitrogen monoxide of the time when said experiments were practiced 20 times by the use of the heater 5 are shown in Figure 3. As the results of these measurements, it was confirmed that in the case of more than 10 times of experiments, the nitrogen monoxide reached an almost equilibrium of adsorption, thus not attenuating any more.

[0021] The results of the experiments with regard to the activation of the catalyst will be reported as follows:

After practicing said experiment 20 times, the heater was switched on for a period of one hour. The temperature of the surface of the heater had been already elevated up to more than 400 °C. The results of the experiments using the catalyst after the completion of this activation process is shown in Figure 4. As known from Figure 4, by this activation process, the catalyst was activated again and actively absorbed and decomposed the absorbed nitrogen oxide.

[0022] According to the present Example as mentioned above, it was possible to realize such a kind of air cleaning machine that might remove the nitrogen oxide

without exchanging the removing agent, by mounting the heater in which the catalyst having the absorbing action and the decomposition action to the nitrogen oxide was provided in the air passage from the suction inlet to the blow out outlet.

[0023] (Example 2) One Example of the second means of the present invention will be explained as follows: In the present Example, a pure aluminum fin was fixed to the heater 5 as mentioned in Example 1, and the catalyst of Example 1 was supported on this fin. Figure 5 shows the shape of this fin. This fin increases the effective area for carrying the catalyst and therefore serves to increase the amount of the catalyst to be carried. Further as the heater 5 used in the present Example, four sheathed heaters having a length of 400 mm, a diameter of 10 mm and a power of 300 W were used. Further the amount of the catalyst to be carried was 10.0 g per heater, resulting in a total of 40.0 g.

[0024] The results of the performance tests for the case of using the heaters 5 carrying the above - mentioned catalysts will be reported on the basis of Figure 6 as follows:

As for this test, the same experiment in the same conditions as those of Example 1 was carried out 50 times and after carrying out 50 times of experiments, the heaters 5 were switched on for a period of one hour for carrying out the activation process and further an experiment to examine the results of this activation was carried out.

[0025] As the results of the present experiment, it was confirmed that the initial performance was improved more than the case of the above - mentioned Example 1. Further after 40 times of experiments, the absorbing action was lost, but when the activation process was carried out, the recovery thereof was confirmed.

[0026] (Example 3) Next one Example of the third means of the present invention will be explained as follows: In the present Example, an aluminum fin was fixed to the heater 5 as mentioned in Example 1, and a hollo (phonetic) was supported on this fin, and further on this hollo (phonetic) the catalyst of Example 1 was supported. By the way the shape of the fin used in the present Example was the same as that used in Example 2. The object of the hollo (phonetic) being supported is to support a greater amount of the catalyst than that of Example 2.

[0027] Next the method of supporting the hollo (phonetic) of the present Example will be explained as follows; As the material for the hollo (phonetic), such was used that was obtained by mixing, with 100 of Frit (phonetic) 4303 - M made by Japan Fellow (phontic), 5 of alumina, 10 of titanium oxide, 2 of clay No. 11, 20 of water glass and 40 of water in this ratio. The thus obtained mixture was sprayed onto the sheathed heater provided with the fin as shown in Figure 5, and it was calcined for five minutes at a temperature of 550 °C thus to obtain the hollo (phonetic). In the present Example, the weight of this hollo (phonetic) to be supported was 5.0 g per heater.

[0028] The weight of the catalyst supported on this hollo (phonetic) was 15.0 g per heater in the present Example. In the present Example, four heaters provided with the catalyst were used in the same manner and therefore, the total weight of the catalyst resulted in 60.0 g.

[0029] The results of the performance tests given to the air clearing machine of the present Example will be explained on the basis of Figure 7 as follows; Figure 7 shows the evaluation of the initial performance, the results of carrying out 100 times of the same experiment as that of Example 1 and the results of further carrying out the experiments after carrying out the activation process by switching on the heater 5 for a period of one hour after carrying out 100 times of said experiments.

[0030] As the results thereof, the initial performance was very excellent. Further the absorbing performance on the half way was also very excellent. Further after 70 times of the experiments, the absorbing performance was saturated, and it was recovered by carrying out the activation process.

[0031] By the way, in the above - mentioned respective Examples, the catalysts used were those having the absorbing and decomposing actions to the nitrogen oxides, thus exhibiting effective actions to the nitrogen oxides, and if such a kind of catalyst were used that might have an effective action to carbon monoxide and hydrocarbon, it would have an effective action to carbon monoxide and hydrocarbon in the same way. As the catalyst which is effective to carbon monoxide, it is possible to mention, such a catalyst obtained by adding various kinds of non - precious metals such as cerium, lanthanum, zirconium and so on to the noble metals such as

platinum, palladium, rhodium and so on. Further as the catalyst which is effective to hydrocarbon, it is possible to mention, such a catalyst that may comprise the oxide of zinc, manganese, iron, titanium and so on, in addition to the above mentioned catalyst of platinum, palladium, rhodium and so on. If the treatment of the present Example were conducted to these catalysts, they would effectively act in the same manner as to the nitrogen oxides.